都市域での暴風の発現に及ぼす台風の影響評価
Assessing the impacts of typhoons on extreme winds in densely-built urban districts

*竹見 哲也[1]、Duan Guangdog[1]、中前 久美[1]
*Tetsuya Takemi[1], Guangdong Duan[1], Kumi Nakamae[1]

1. 京都大学防災研究所
1. Disaster Prevention Research Institute, Kyoto University

A gusty wind by typhoons is one of the major natural hazards and has been the most threatening windstorm in urban districts. In Osaka City, the recorded highest instantaneous wind speed reached up to 60 m/s. The recent intense tropical cyclone, Typhoon Jebi, which landed the central part of Japan in September 2018 with the lifetime minimum central pressure of 915 hPa and the maximum wind speed of 48 m/s, exhibited a similar track compared to past disastrous typhoons: Typhoon Nancy (1961) and Muroto Typhoon (1934). Urban surface roughnesses, e.g. building obstacles, exert significant influences on the magnitude of wind gustiness. With the growing urbanization globally, quantification of turbulent winds in densely-built, urban districts is important to the assessment and prediction of risks of wind damages and the understanding of the underlying physical mechanisms. The influlences of densely built urban environments on the occurrence of wind gusts in urban districts of Osaka and Kyoto City during the landfall of Typhoon Jebi are studied by merging mesoscale meteorological and building-resolving large-eddy simulations (LES), which allows an explicit representation of the complicated building structures while retaining the strong mesoscale perturbations from the typhoon. With the successful reproduction of the track and intensity of the typhoon in meteorological simulations, the simulated winds at the boundary-layer top of the LES model are used to quantify the wind gusts in the urban district. The maximum wind gust in the analysis area of Osaka is around 60-70 m/s, which is comparable to the wind speed at the height of about 300 m. Such wind gusts are generated by the instantaneous downward momentum transfer in areas, where buildings with a high variability in the height are clustered. The instantaneous wind gusts are found to be the strongest when the building packing density is moderate. The results suggest that the risks of wind damages are mostly likely to be maximized in urban districts where the building height is highly variable and the packing density is moderate.

キーワード：暴風、都市災害、都市気象、乱流、気候変動影響、台風
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